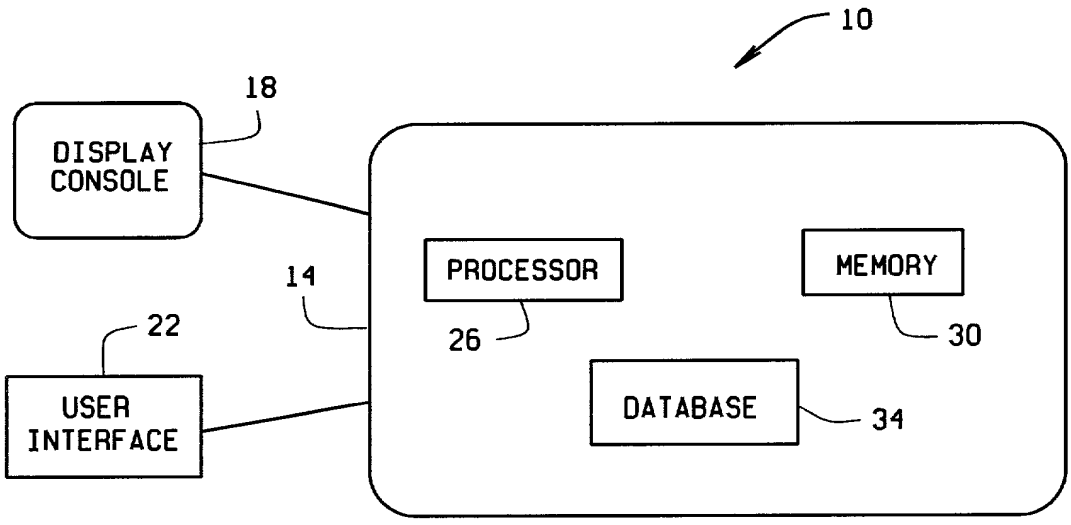
10
18
DISPLAY CONSOLE
14
PROCESSOR
26
MEMORY
30
22
USER INTERFACE
DATABASE
34

FIG. 1

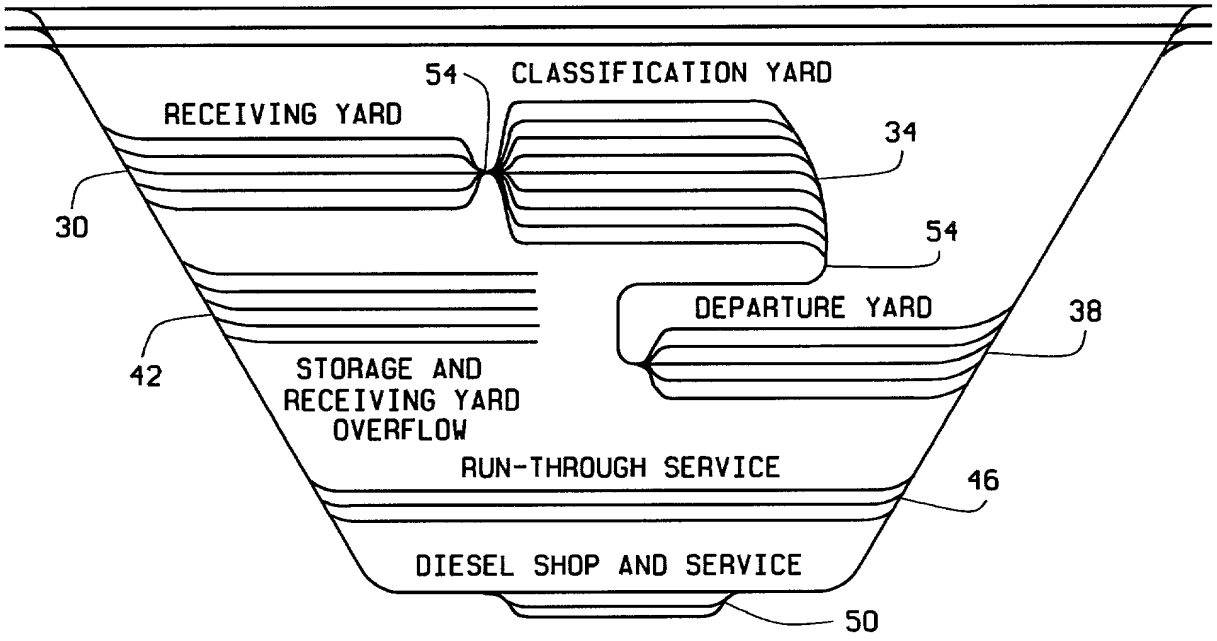
54
CLASSIFICATION YARD
RECEIVING YARD
34
30
54
DEPARTURE YARD
38
42
STORAGE AND RECEIVING YARD OVERFLOW
RUN-THROUGH SERVICE
46
DIESEL SHOP AND SERVICE
50

FIG. 2

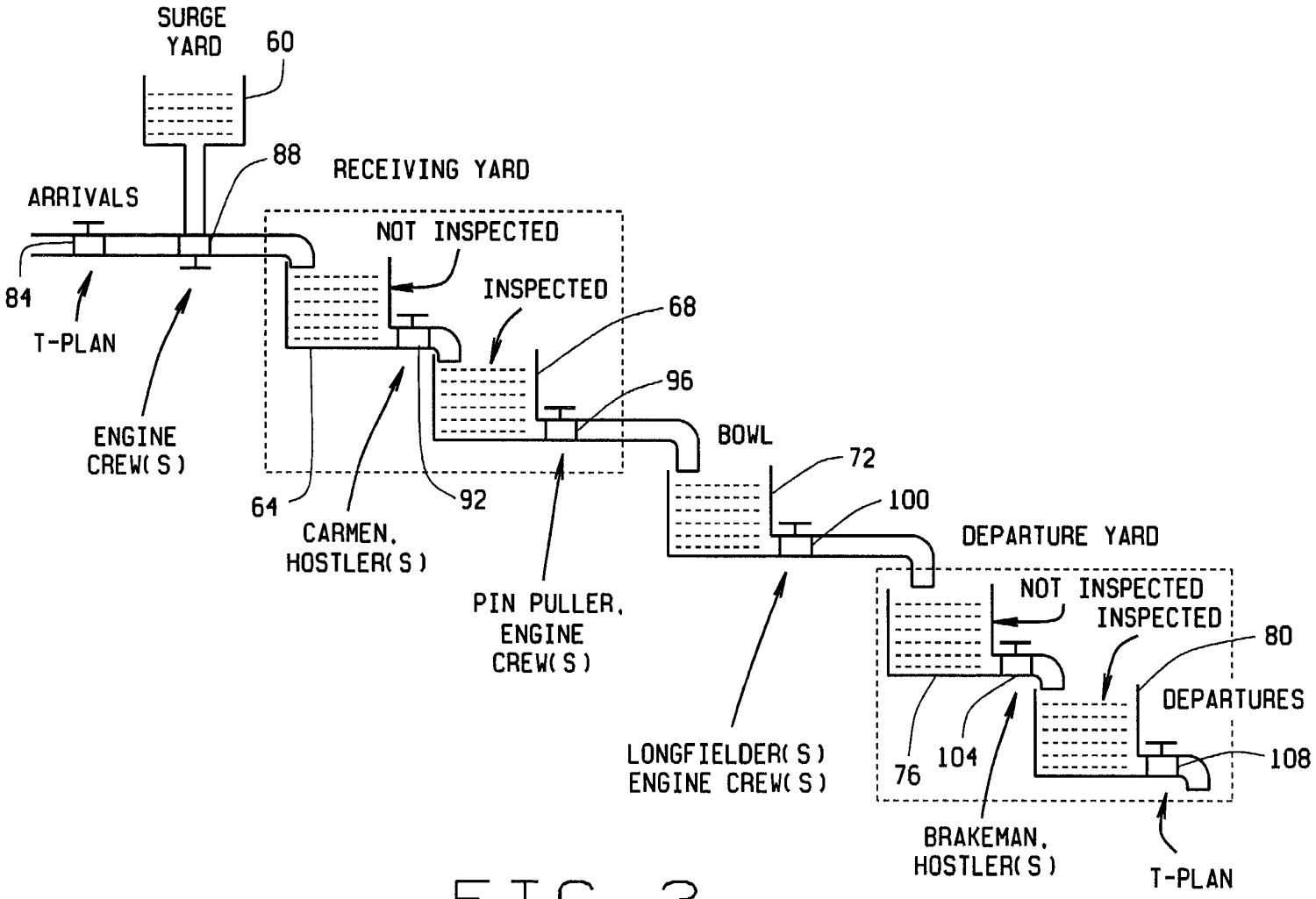
SURGE YARD
60
88
RECEIVING YARD
ARRIVALS
NOT INSPECTED
INSPECTED
68
96
84
T-PLAN
ENGINE CREW(S)
64
CARMEN, HOSTLER(S)
92
PIN PULLER, ENGINE CREW(S)
BOWL
72
100
DEPARTURE YARD
NOT INSPECTED
INSPECTED
80
DEPARTURES
LONGFIELDER(S) ENGINE CREW(S)
76
104
108
BRAKEMAN, HOSTLER(S)
T-PLAN

FIG. 3

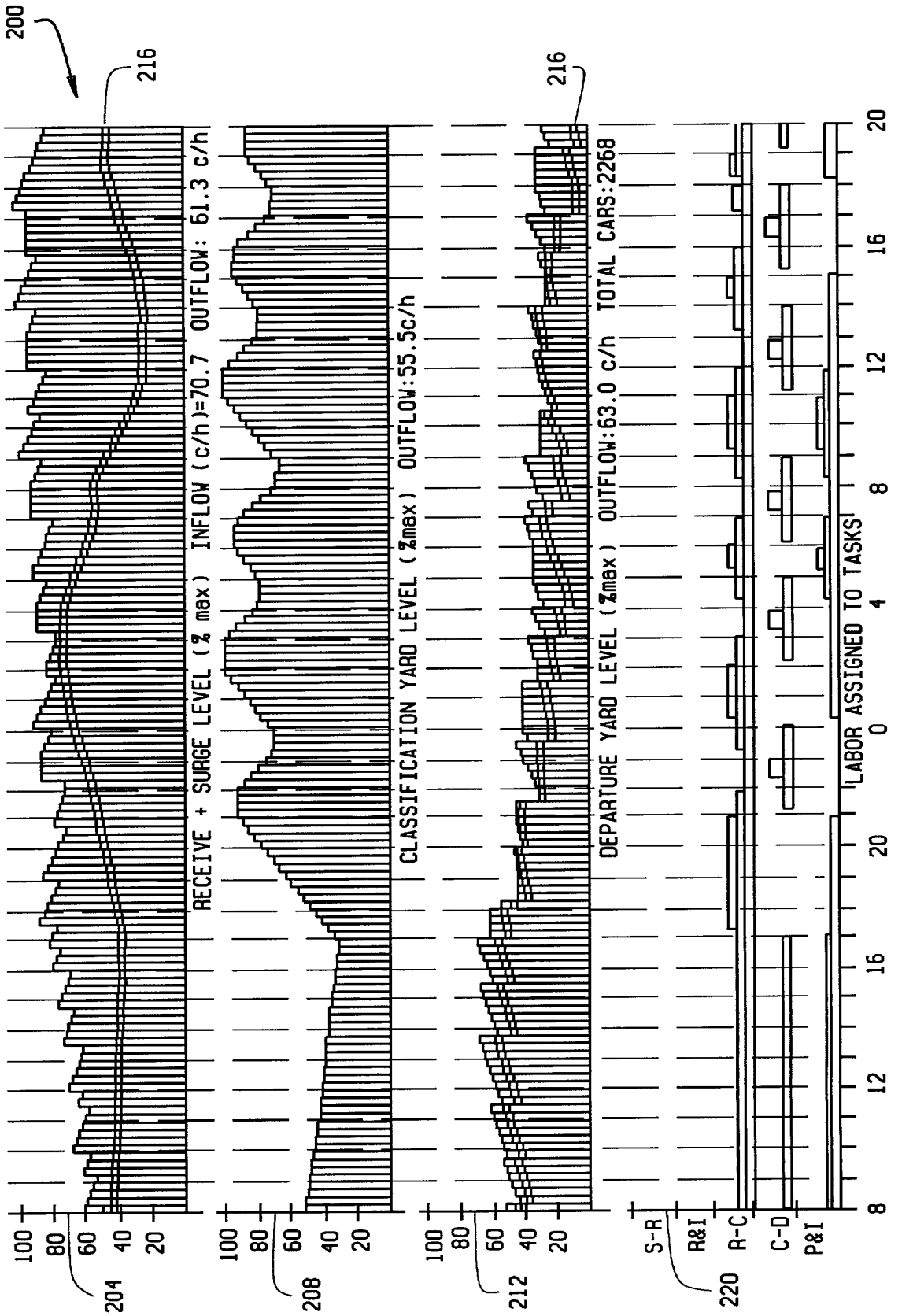
200
216
RECEIVE + SURGE LEVEL (% max) INFLOW (c/h)=70.7 OUTFLOW: 61.3 c/h
CLASSIFICATION YARD LEVEL (%max) OUTFLOW:55.5c/h
DEPARTURE YARD LEVEL (%max) OUTFLOW:63.0 c/h TOTAL CARS:2268
100
80
60
40
20
204
208
212
S-R
R&I
R-C
C-D
P&I
220
8
12
16
20
0
4
8
12
16
20
LABOR ASSIGNED TO TASKS

FIG. 4

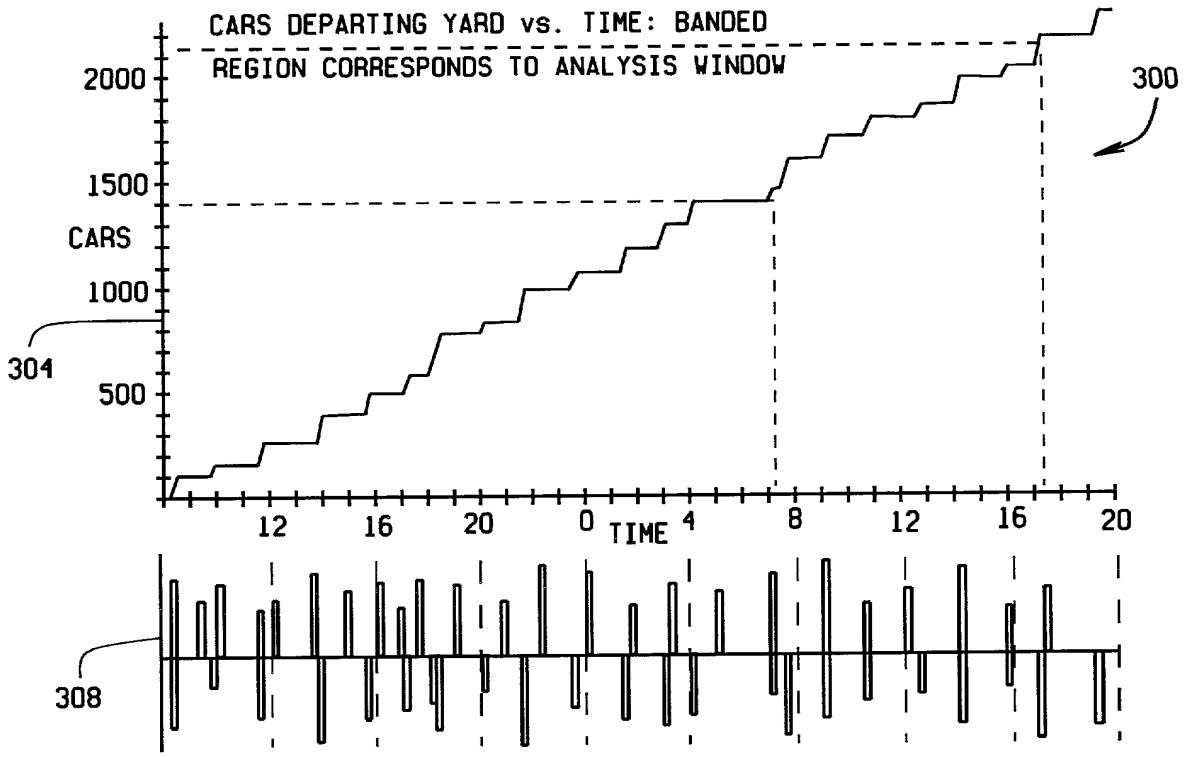
CARS DEPARTING YARD vs. TIME: BANDED
REGION CORRESPONDS TO ANALYSIS WINDOW
300
2000
1500
CARS
1000
500
304
12
16
20
0
TIME
4
8
12
16
20
308

FIG. 5

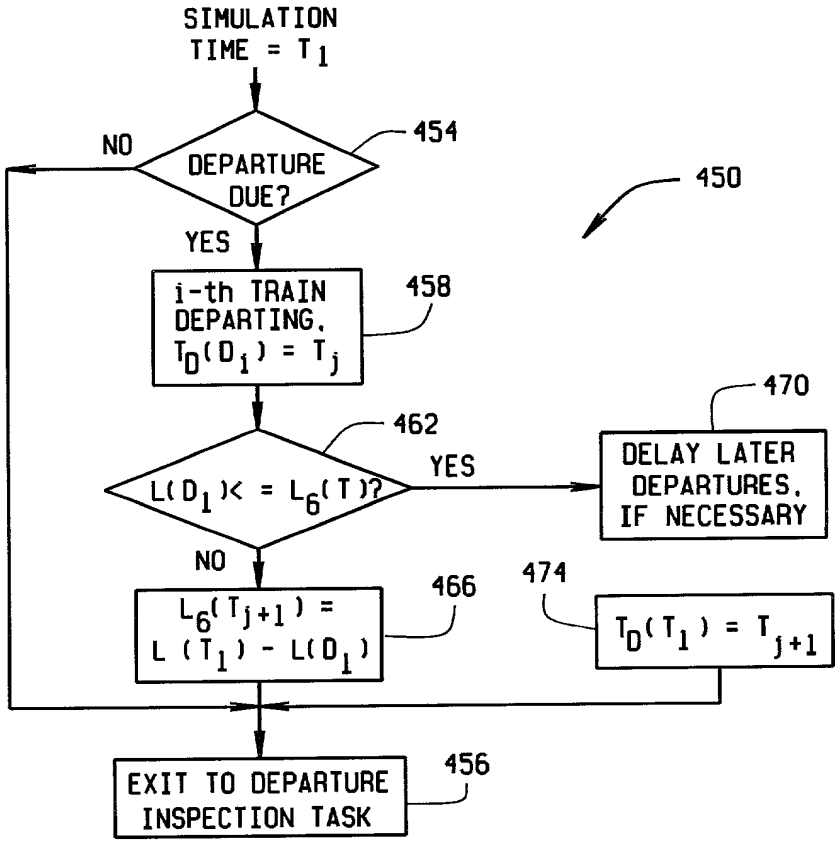
SIMULATION TIME = T_1
454
NO
DEPARTURE DUE?
YES
450
458
i-th TRAIN DEPARTING, $T_D(D_i) = T_j$
462
470
$L(D_1) <= L_6(T)$?
YES
DELAY LATER DEPARTURES, IF NECESSARY
NO
466
474
$L_6(T_{j+1}) = L(T_1) - L(D_1)$
$T_D(T_1) = T_{j+1}$
456
EXIT TO DEPARTURE INSPECTION TASK

FIG. 7

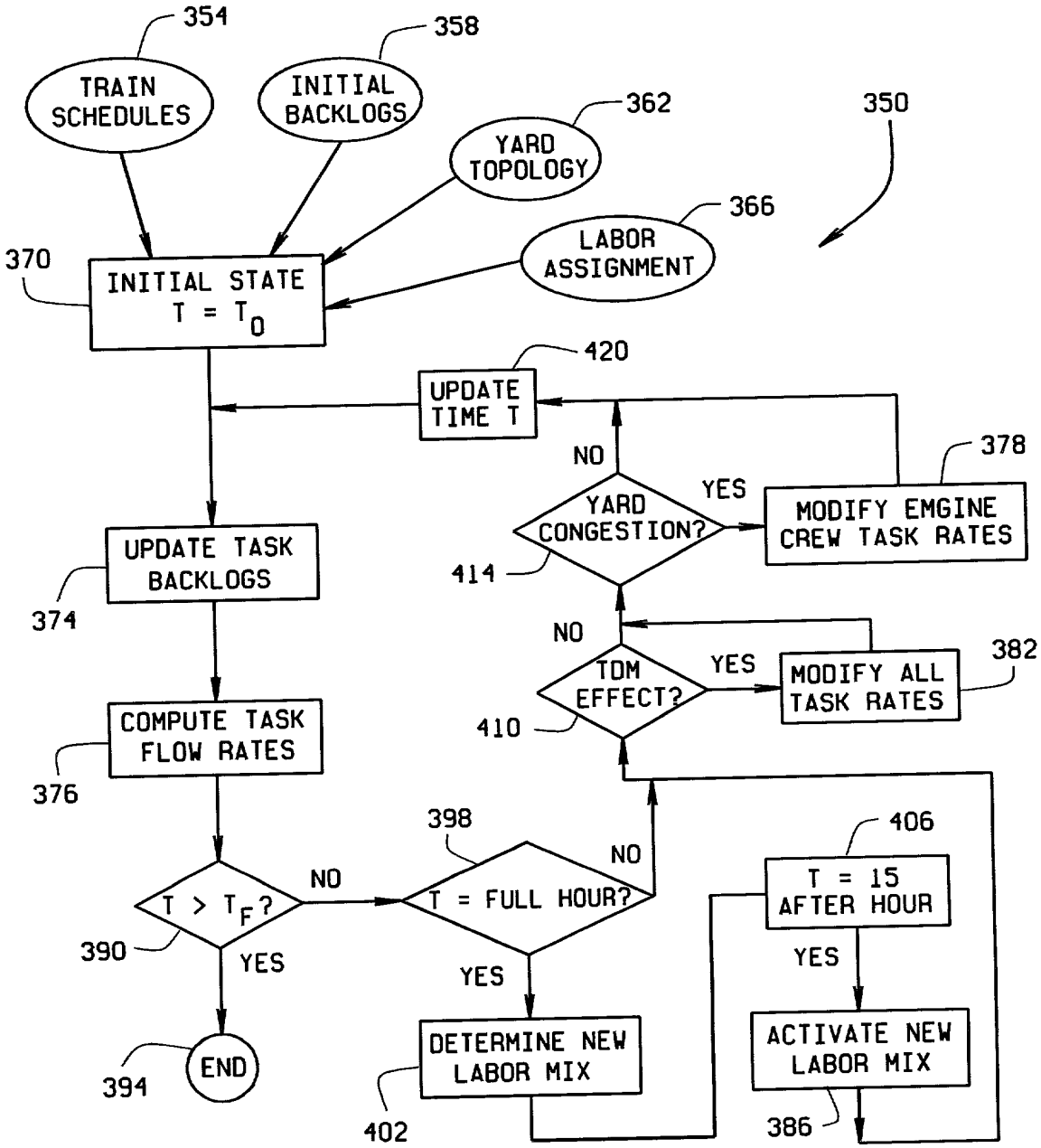
354
TRAIN SCHEDULES
358
INITIAL BACKLOGS
362
YARD TOPOLOGY
350
366
LABOR ASSIGNMENT
370
INITIAL STATE T = T0
420
UPDATE TIME T
NO
YES
YARD CONGESTION?
414
378
MODIFY EMGINE CREW TASK RATES
UPDATE TASK BACKLOGS
374
NO
TDM EFFECT?
410
YES
MODIFY ALL TASK RATES
382
COMPUTE TASK FLOW RATES
376
398
NO
T = FULL HOUR?
406
T = 15 AFTER HOUR
T > TF?
NO
390
YES
YES
YES
END
394
DETERMINE NEW LABOR MIX
ACTIVATE NEW LABOR MIX
402
386

FIG. 6

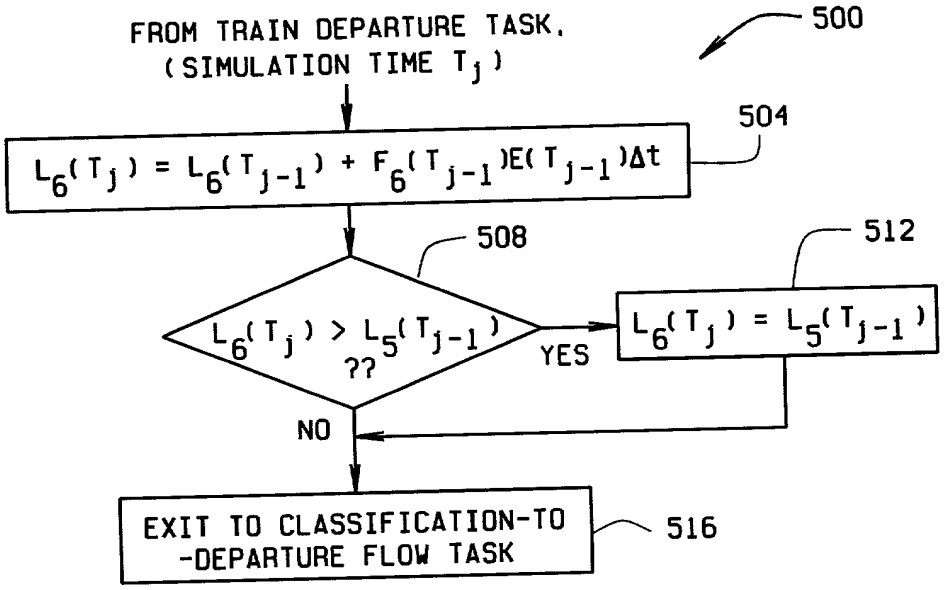
FROM TRAIN DEPARTURE TASK, (SIMULATION TIME T_j)
500
$L_6(T_j) = L_6(T_{j-1}) + F_6(T_{j-1})E(T_{j-1})\Delta t$
504
508
$L_6(T_j) > L_5(T_{j-1})$??
YES
512
$L_6(T_j) = L_5(T_{j-1})$
NO
EXIT TO CLASSIFICATION-TO-DEPARTURE FLOW TASK
516

FIG. 8

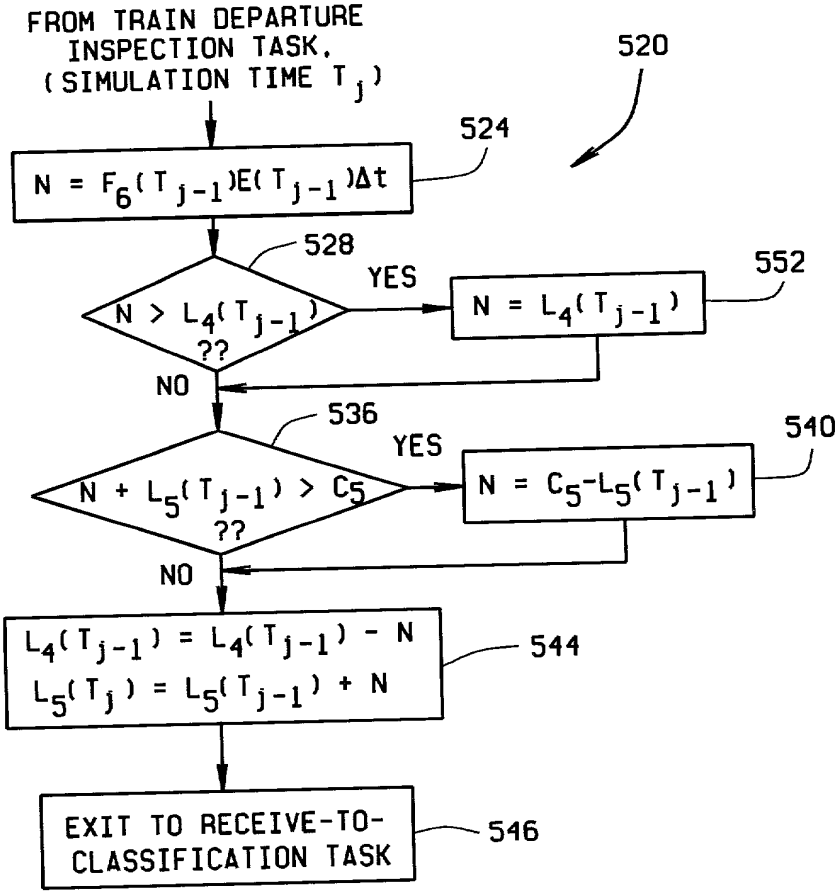
FROM TRAIN DEPARTURE INSPECTION TASK, (SIMULATION TIME T_j)
520
$N = F_6(T_{j-1})E(T_{j-1})\Delta t$
524
528
$N > L_4(T_{j-1})$??
YES
552
$N = L_4(T_{j-1})$
NO
536
$N + L_5(T_{j-1}) > C_5$??
YES
540
$N = C_5 - L_5(T_{j-1})$
NO
$L_4(T_{j-1}) = L_4(T_{j-1}) - N$
$L_5(T_j) = L_5(T_{j-1}) + N$
544
EXIT TO RECEIVE-TO-CLASSIFICATION TASK
546

FIG. 9

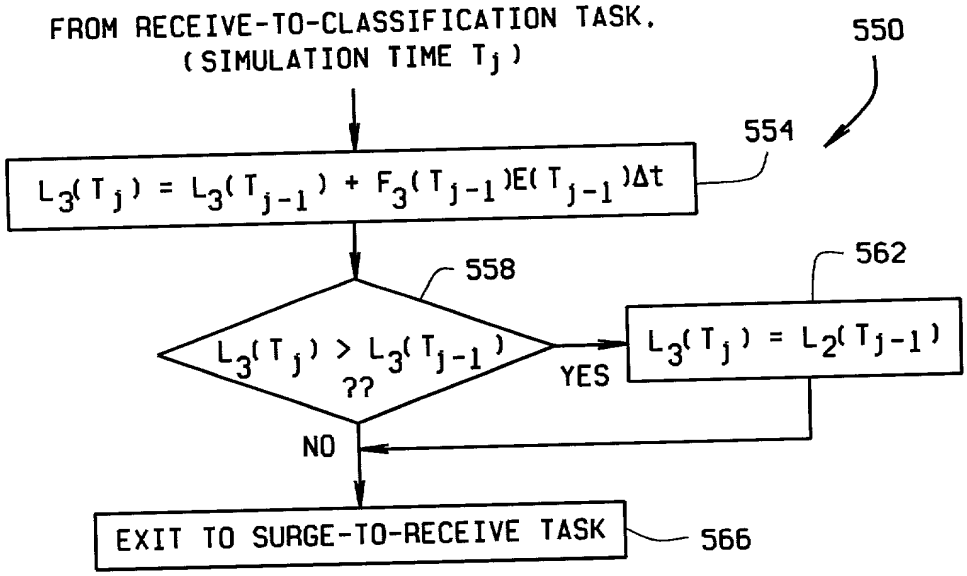
FROM RECEIVE-TO-CLASSIFICATION TASK.
(SIMULATION TIME T_j)
550
554
$L_3(T_j) = L_3(T_{j-1}) + F_3(T_{j-1})E(T_{j-1})\Delta t$
558
562
$L_3(T_j) > L_3(T_{j-1})$??
YES
$L_3(T_j) = L_2(T_{j-1})$
NO
EXIT TO SURGE-TO-RECEIVE TASK
566

FIG. 10

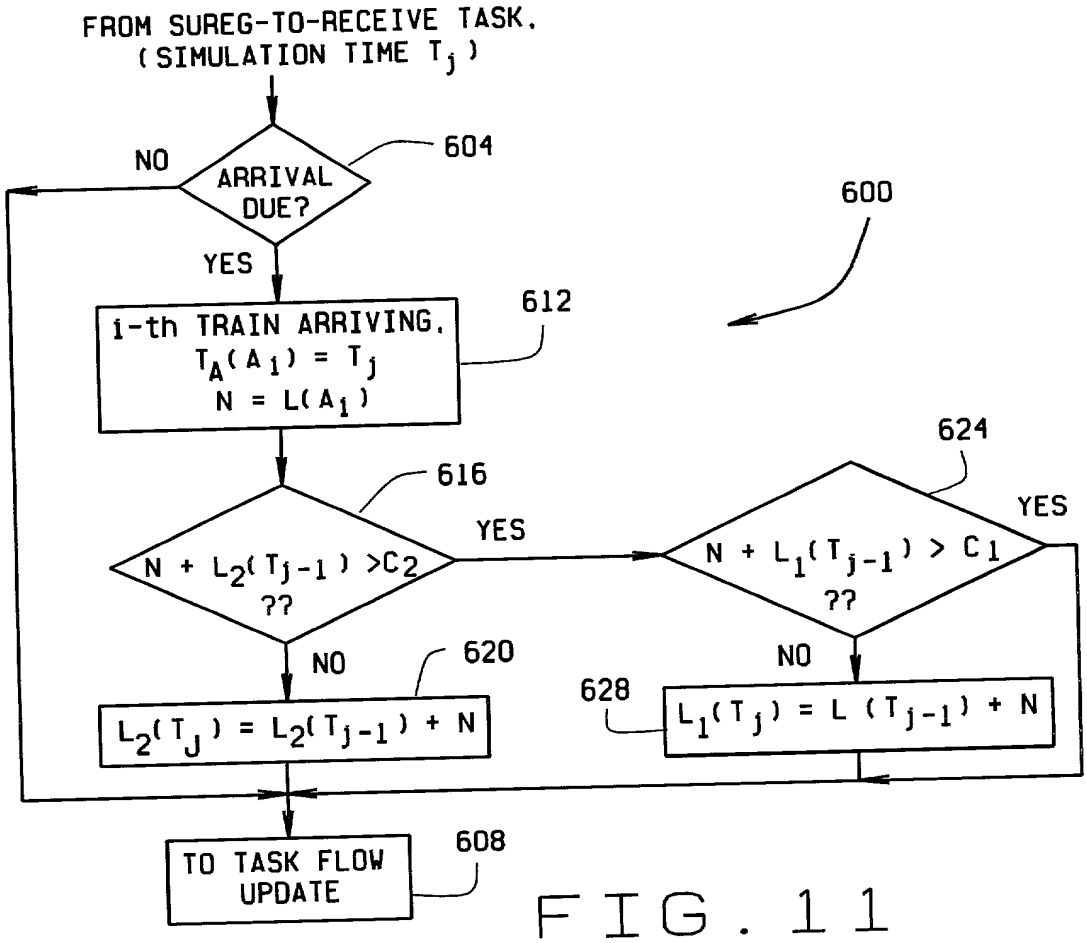
FROM SUREG-TO-RECEIVE TASK.
(SIMULATION TIME T_j)
NO
ARRIVAL DUE?
604
600
YES
i-th TRAIN ARRIVING.
$T_A(A_1) = T_j$
$N = L(A_1)$
612
624
616
YES
YES
$N + L_2(T_{j-1}) > C_2$??
$N + L_1(T_{j-1}) > C_1$??
NO
620
NO
628
$L_2(T_J) = L_2(T_{j-1}) + N$
$L_1(T_j) = L(T_{j-1}) + N$
TO TASK FLOW UPDATE
608

FIG. 11

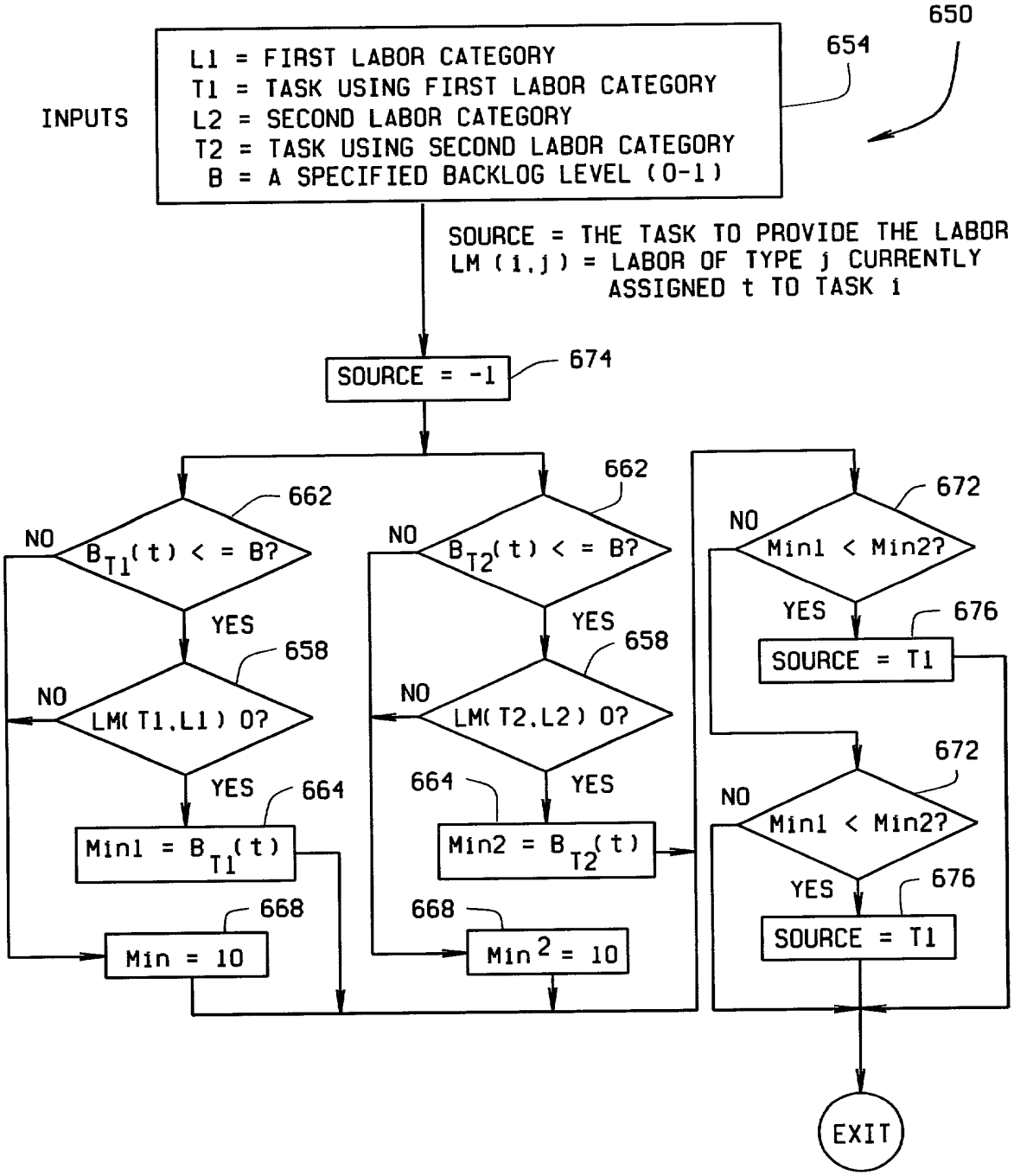
650
654
INPUTS
L1 = FIRST LABOR CATEGORY
T1 = TASK USING FIRST LABOR CATEGORY
L2 = SECOND LABOR CATEGORY
T2 = TASK USING SECOND LABOR CATEGORY
B = A SPECIFIED BACKLOG LEVEL (0-1)
SOURCE = THE TASK TO PROVIDE THE LABOR
LM (i,j) = LABOR OF TYPE j CURRENTLY ASSIGNED t TO TASK i
SOURCE = -1
674
662
NO
$B_{T1}(t) <= B$?
YES
658
NO
LM(T1,L1) 0?
YES
664
Min1 = $B_{T1}(t)$
668
Min = 10
662
NO
$B_{T2}(t) <= B$?
YES
658
NO
LM(T2,L2) 0?
664
YES
Min2 = $B_{T2}(t)$
668
Min 2 = 10
672
NO
Min1 < Min2?
YES
676
SOURCE = T1
672
NO
Min1 < Min2?
YES
676
SOURCE = T1
EXIT

FIG. 12